Small Business Innovation Research/Small Business Tech Transfer

Detecting life in Ocean Worlds with low-capacitance solid-state nanopores, Phase I

Completed Technology Project (2018 - 2019)

Project Introduction

The goals of this proposal to develop a robust solid-state nanopore platform are directly aligned with the **SeqLOW COLDTech development goals** for the Development of Nanopore Sequencing for Automated Ocean World Life Detection led by **Program Officer Dr. Christopher McKay** at the NASA Ames Research Center. The specific goals include the robust fabrication of solid-state nanopore membranes and nanopore arrays with different pore diameters tailored for detection of multiple types of biomarkers depending on their sizes and expected properties (i.e. DNA, charged proteins, amino acids, etc.). Further development of this platform needs to include the integration of nanopore chips with microfluidics and also, on chip electronics, suitable to produce a compact, integrated and self-contained platform that is small, portable and sufficiently robust to be suitable for long duration space missions. As described below, protein pore-based DNA sequencers, now in the process of beta-testing by **Oxford Nanopores (the Minion)**, are not robust enough for space exploration applications, and there is a need to replicate successes of protein pores in solid-state membranes such as silicon, graphene, metal dichalcogenides or other promising materials that can be fabricated in the form of thin membranes. The need for accuracy for this NASA application to detect and prove the potential existence of extant life, although synergistic, may be somewhat different than the DNA sequencing requirements that has been the focus of the Minion. Specifically, here we seek to potentially detect and distinguish between a range of small biomolecules, including aminoacids, lipids, and other. This requires a range of robust nanopores of controlled diameters and properties, optimally sensitive to different analytes.

Anticipated Benefits

This project is directly aligned with the **SeqLOW COLDTech** development goals for the Development of Nanopore Sequencing for Automated Ocean World Life Detection led by Program Officer **Dr. Christopher McKay** at the NASA Ames Research Center.

The proposed nanopore technology developed as part of this NASA SBIR project can also be applied by the Environmental Protection Agency in their projects related to measuring the quality of water. For example, the 2017 SBIR solicitation by the EPA included two focus areas involving water testing. The US Department of Agriculture also regularly has a need for novel water analysis instruments. For example, the 2017 USDA SBIR solicitation had three focus areas related to water analysis.

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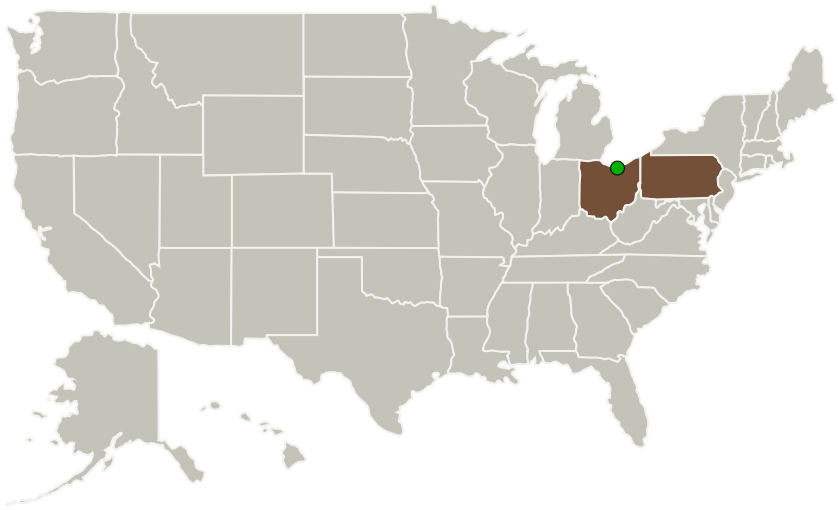
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
GOEPPERT, LLC	Lead Organization	Industry Women-Owned Small Business (WOSB)	Philadelphia, Pennsylvania
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Ohio	Pennsylvania

Project Transitions

July 2018: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

GOEPPERT, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

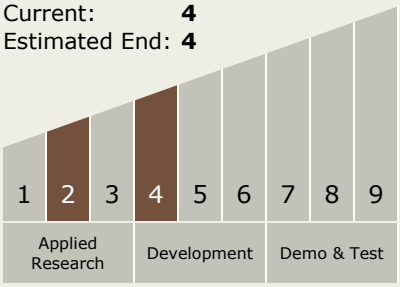
Carlos Torrez

Principal Investigator:

David Niedzwiecki

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



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February 2019: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/141008)*

Images

Final Summary Chart Image
Detecting life in Ocean Worlds with low-capacitance solid-state nanopores, Phase I
(https://techport.nasa.gov/image/135031)

Project Image
Detecting life in Ocean Worlds with low-capacitance solid-state nanopores, Phase I
(https://techport.nasa.gov/image/136090)

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes

Target Destination

Others Inside the Solar System